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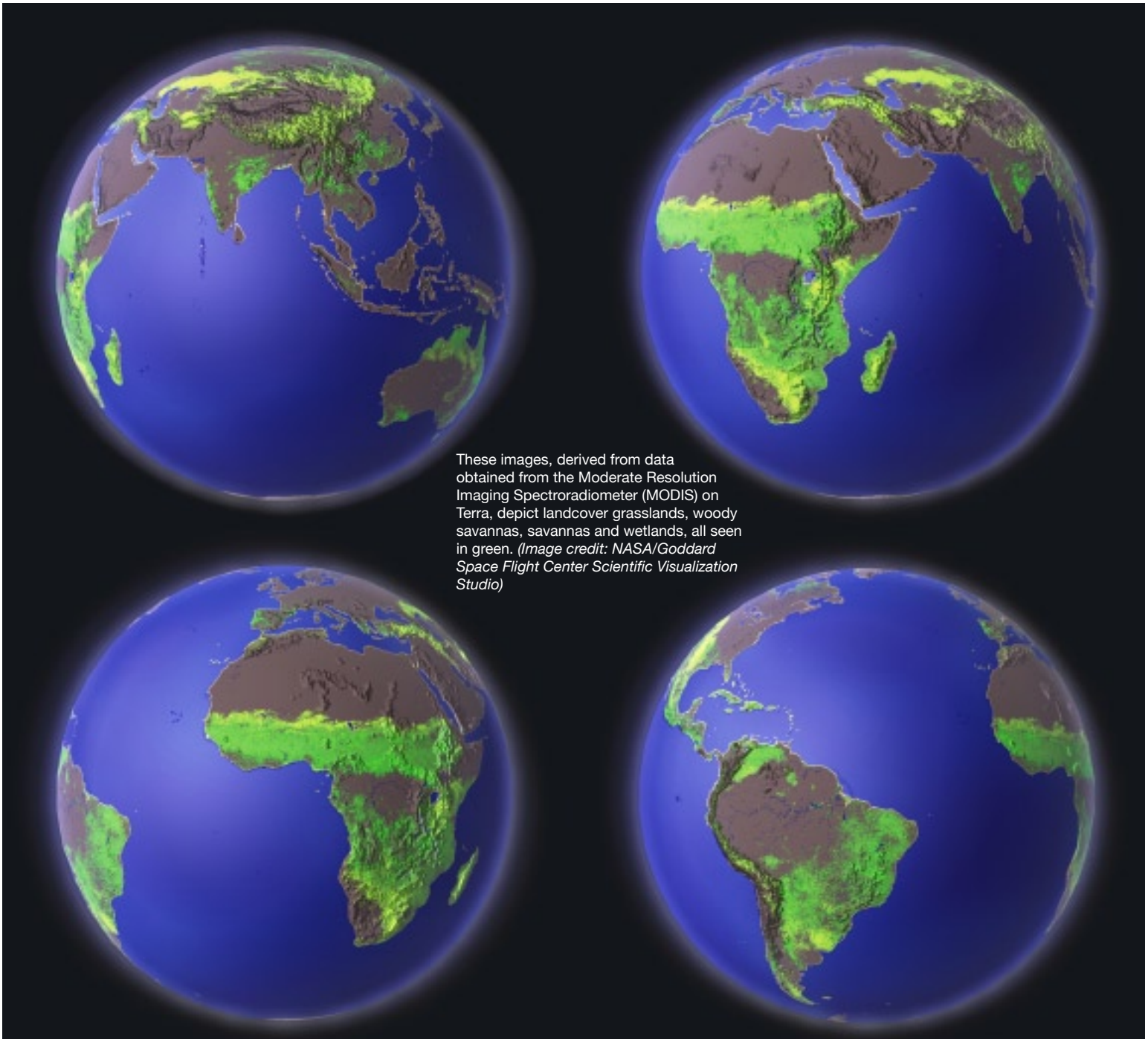
EYES ON AGRICULTURE



These images, derived from data obtained from the Moderate Resolution Imaging Spectroradiometer (MODIS) on Terra, depict landcover grasslands, woody savannas, savannas and wetlands, all seen in green. *(Image credit: NASA/Goddard Space Flight Center Scientific Visualization Studio)*

Scott Bauer/ARS/USDA

The results of NASA research and developments in Earth science and technology can be integrated into local and regional decision support systems addressing issues related to weather and climate predictions in agriculture management.

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Overview of the Program

At present, an array of Earth observing satellites are in orbit, and additional launches both by NASA and others will continue throughout the next decade. Our ability to observe our home planet from space has never been greater and will continue to grow. Increasingly, studies of the Earth focus on understanding the Earth's land, atmosphere, oceans, and various forms of life as a single integrated system rather than as individual independent elements. NASA is an important contributor in this systems approach to Earth Science studies.

Scientists at NASA work in partnership with other government, academic, private, and international organizations to identify ways to link Earth Science information to practical uses for society. Some of these partners contribute *decision support systems (DSS)* that help non-traditional users of Earth Science data use the information to make important decisions concerning environmental issues. The goal is to make sure Earth science data and information flows smoothly *from satellite to society*, so that the maximum number of people possible benefit from Earth Science information.

Agricultural Competitiveness

One of our nation's most vital needs is a stable and dependable food supply for an ever-increasing population. The Midwest United States is known as America's "Breadbasket" because it is home to the vast majority of America's productive farmland and is a vital cog in the American economy. Any disruption to the productivity of these lands can have devastating economic consequences. For example, in the summer of 1988, the Midwest United States experienced its worst dry spell since the 1930s causing an estimated $40 billion in crop damages. In contrast, summer 1993 was exceptionally wet, with flooding on the Missouri and Mississippi rivers that wreaked havoc on agricultural lands and caused extensive crop damage.

These contrasting examples illustrate that the Midwest is actually subject to a wide range of climatic extremes ranging from scorching summer heat to bitter Arctic cold, from abundant rains to parched soils. Research indicates that many of these year-to-year changes in local weather conditions can be associated with changes in global scale climatic phenomena such as the El Niño/La Niña cycle in the Pacific Ocean. Further complicating the matter, every El Niño/La Niña episode is different (in strength or duration, for example) and so their effects on weather around the world are not always the same.

In order to improve our agricultural competitiveness as a nation, an increased understanding of the ties between global phenomena and local weather effects is needed so that weather extremes such as the ones mentioned above can be better predicted with more and more lead-time. As an example, reliable forecasts of precipitation and surface temperatures provided a season ahead would have an enormous global economic impact. NASA recently signed an agreement with the U.S. Department of Agriculture (USDA) covering a series of programs to help protect the environment and enhance American agriculture. The new collaboration allows for the use of NASA's capabilities in monitoring, mapping, modeling and systems engineering to enhance USDA's ability to predict climate, weather and natural hazards. NASA also collaborates with the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) on this effort to better understand the complexities of the seasonal variability of climate. Their goal is to provide accurate and timely information to farmers and organizations responsible for food and water management decisions that can potentially impact millions of Americans.

Space provides an ideal vantage point for the collection of critical data for agricultural applications, such as precipitation, soil moisture, snow water content, and vegetation maps, as well as ocean surface temperatures, and ocean biology, to help monitor existing anomalies and improve climate forecasts. Measurements obtained by satellite sensors such as the sophisticated Moderate Resolution Imaging Spectroradiometer (MODIS) on both Terra and Aqua, and the Advanced Microwave Scanning Radiometer for EOS (AMSR-E) on Aqua make important contributions to these studies. Landsat 7 is the latest in a series of Landsat missions that have been providing high-resolution images of the land surface since 1972. These images are very helpful for identifying how the land surface is changing with time and can be applied to many agricultural applications. A Landsat Data Continuity Mission (LDCM) is planned, which will extend the Landsat data record into the next decade. The Gravity Recovery and Climate Experiment (GRACE) provides a new means of calculating water storage changes over continents—an extremely important factor in the continued sustainability of the U.S. Great Plains for agricultural production. The Tropical Rainfall Measuring Mission (TRMM) provides information on global precipitation, and will be succeeded by the Global Precipitation Measurement (GPM) mission later this decade, a constellation of satellites that will provide even more information on precipitation.

However, the story doesn't end with the collection of the data. The real value of space-based measurements begins to be realized when data collected by these NASA missions are input into models that simulate the actual conditions and whose output is used for agricultural decision making. Over the next 10 years, as more and more detailed information is added to these models, the simulations produced will lead to forecasts with increased accuracy and longer lead times, providing farmers the information they need to plan for the impacts of the weather in advance.

NASA's Earth Science Enterprise (ESE) is international in scope with participation by the U.S., the European Space Agency, France, Canada, Japan, Russia, Brazil, The Netherlands, and Finland. The ESE works collaboratively with national and international scientists as well as with its Federal partners to provide quality science observations and predictions as input into weather and climate prediction models used for agricultural applications. NASA is committed to expanding the use of Earth Science results to serve as decision support tools for the benefit of society.

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